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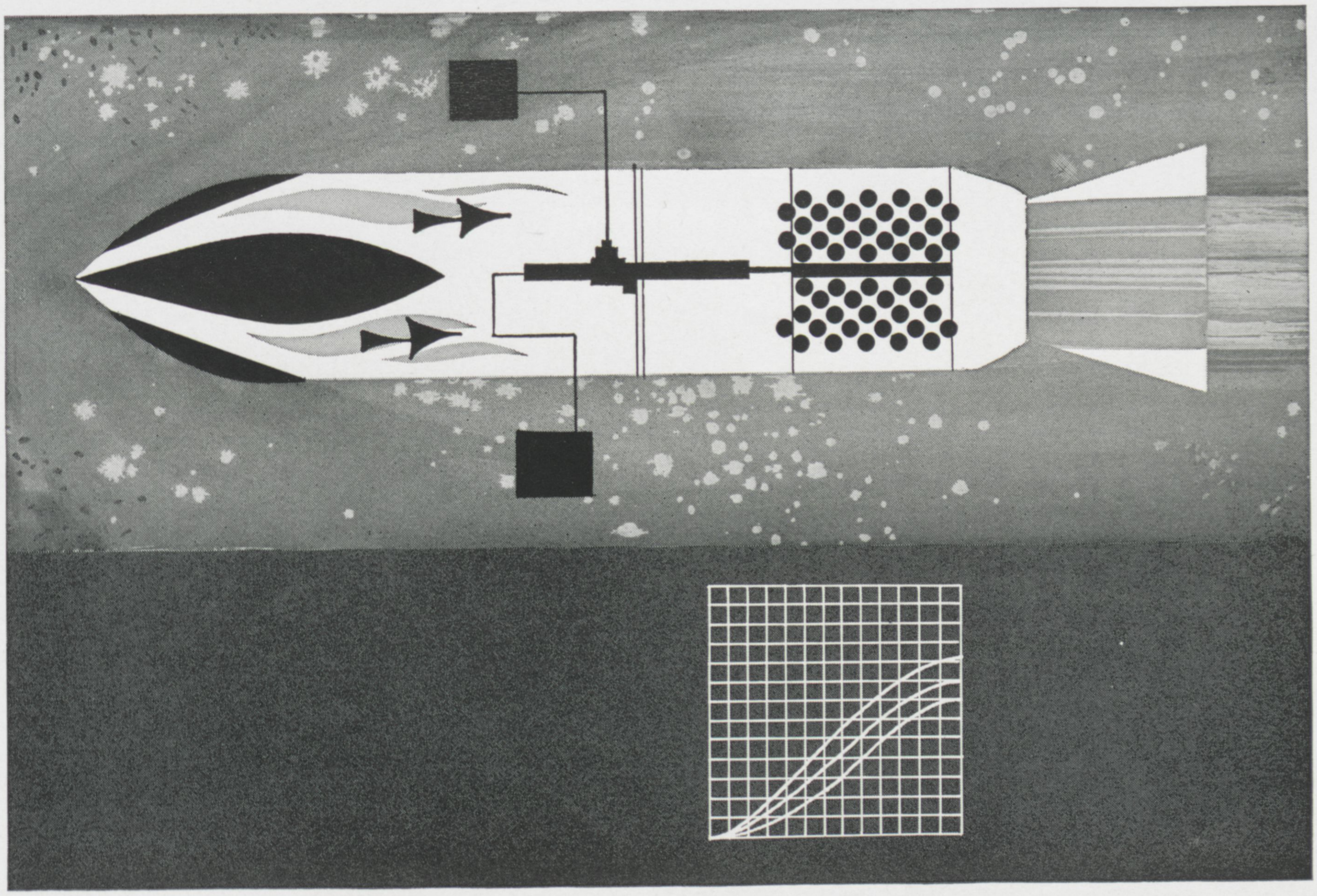
Rose Technic Staff
*Rose-Hulman Institute of Technology*

# Rose Technic

January, 1962

*In This Issue:*

SCIENCE GOD
ELECTRICAL ENGINEERING
TBPi PLEDGE ESSAY



# BENDIX IN SCIENCE AND ENGINEERING:

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#  Rose Technic

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### Cover Note

This month's cover appears through the courtesy of Pennsalt Chemicals Corporation. The gasket shown is made of KYNAR, a new corrosion and radiation resistant, formable plastic produced by Pennsalt. The photograph is one used in a series of advertisements featuring corporate marketing activities.

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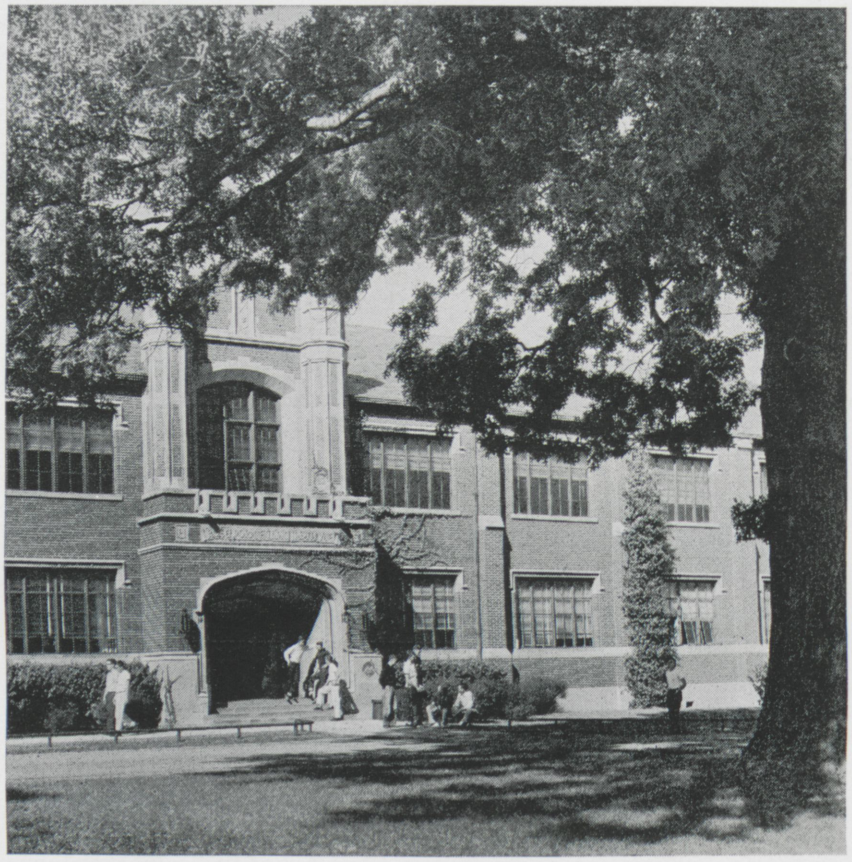

# ROSE

ROSE POLYTECHNIC INSTITUTE

TERRE HAUTE, INDIANA

**HIGH SCHOOL GRADUATES OF 1962**

You are cordially invited to visit Rose Polytechnic Institute where you can earn a degree in:

- CHEMICAL ENGINEERING
- ELECTRICAL ENGINEERING
- MECHANICAL ENGINEERING
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- MATHEMATICS
- PHYSICS
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ROSE POLYTECHNIC
INSTITUTE
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# Let's Get Our Money's Worth

Every new semester brings forth a barrage of vows and resolutions for better study habits. We decide that we'll study harder than ever before to get the grades this semester that we could have gotten last semester but didn't. Over Christmas vacation we sat down and did a little thinking about the number of semesters we have left to make our grades before graduation, and decided that this new semester better be the one that starts the upward trend. We set ideals, and as the semester gets into full swing we burn midnight oil living up to them.

At Rose, however, it takes approximately two weeks for this enthusiasm to wane. We lose sight of the goals we set, and the only midnight oil burning is on those nights before tests, or on nights before labs or term papers are due. We fall behind in several courses and begin to lose interest in them. We begin to participate in late discussions, and become experts in rationalizing ourselves out of studying.

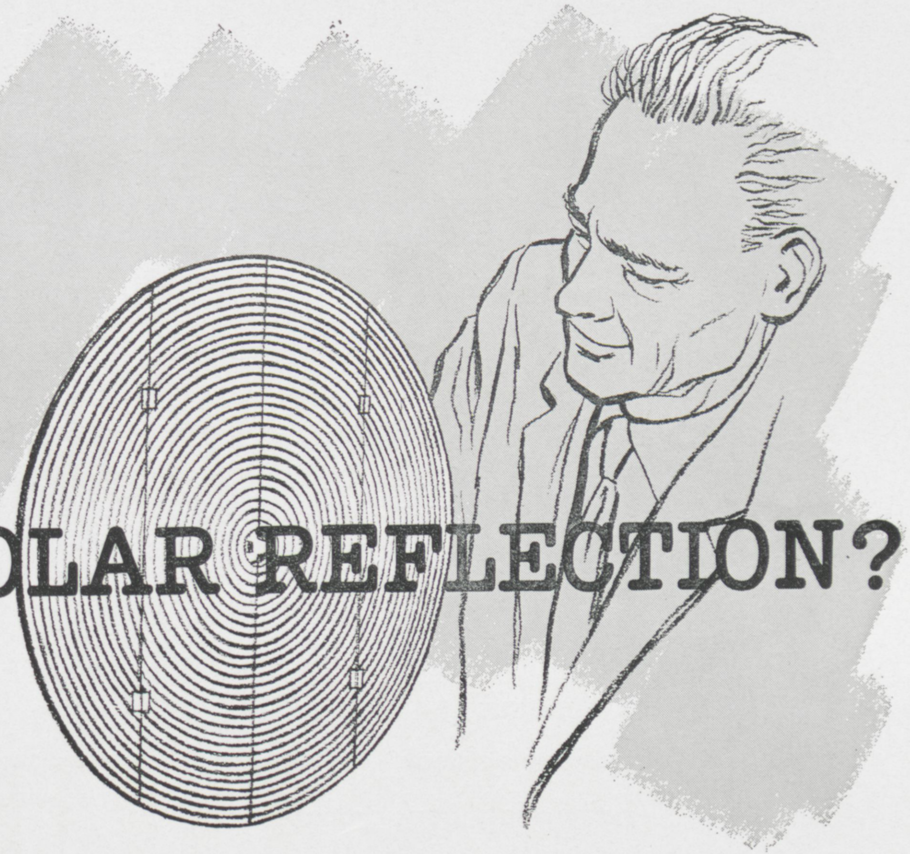
As a result our grades at six and twelve weeks aren't quite as high as we had hoped, but we keep telling ourselves that these reports don't count anyway; they aren't on the records. We never look forward to finals, but we begin to believe that they will be the factor that pulls us through, and we end up in the same old rut we were in at the end of the past semester.

Set goals this semester, but make them realistic. If we set impossible goals it is easier to get discouraged when we can't reach them. Make resolutions for longer study hours, and live up to them. Stay out of the television room during your scheduled study hours. Stay away from the pocket novels, sexy magazines, and all night discussions that accomplish nothing but depression and bleary eyes the following day. Keep up in your courses and you won't lose interest.

Let's decide that we want to study, that we want to learn, and that we want the grades that make our parents, our wives, and our future employers so happy. This semester is the one to pick up the shovel and keep digging until we turn over a great big pile of success for ourselves. This is the semester that'll start the trend.

*J. G. G.*

# Take a new direction in SOLAR REFLECTION?



● That's just what we did at Allison.

Studies indicated that the Fresnel principle could be adapted to an extremely lightweight, foldable solar collector for operation of power systems.

Our researchers went to work, aided by Allison's extensive resources—our physical optics and metallurgical laboratories, American and European consultants, our Scientific Advisory Board and every resource General Motors possesses.

Results—a Fresnel mirror which can collect and concentrate solar energy to run direct conversion systems, Stirling cycle engines, Rankine cycle mercury turbines, solar regenerated fuel cells and numerous other devices which will provide electric power for space missions.

Allison's solar reflector utilizes such significant design characteristics as:

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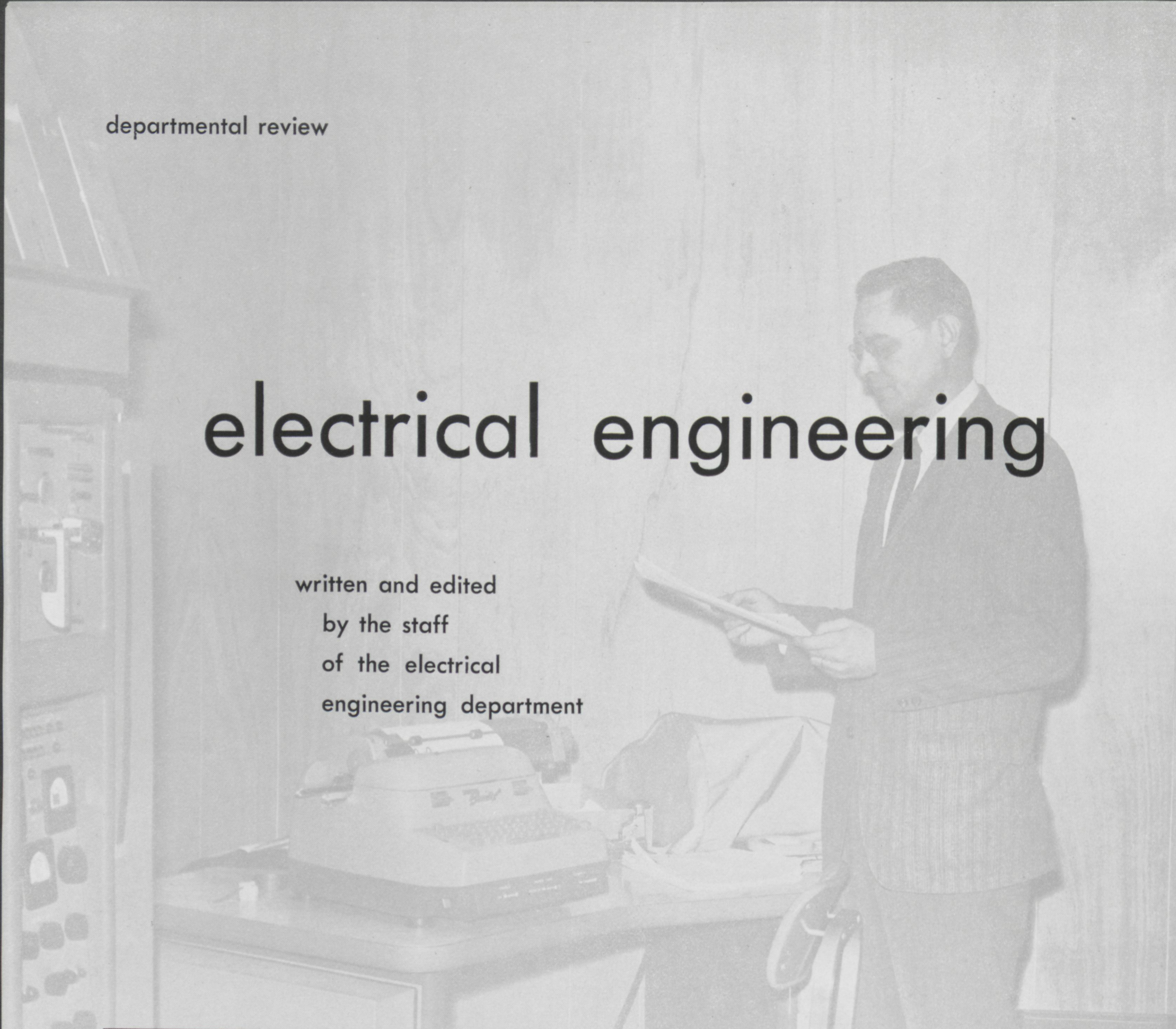
And this is but one example of Allison technology at work. Current research investigations encompass four basic energy conversion systems: open and closed cycle gas turbines, Stirling-cycle engines, direct energy conversion devices and rockets. From this research into solar and nuclear as well as chemical energy will develop many of the primary and auxiliary power systems of the future.

But concepts are constantly changing, and Allison is ever probing new forms of energy conversion in the search for improved forms of propulsion and power. And as the research devices of today become the power systems of the future, Allison will continue its history of pioneering and progress in power.

*Energy Conversion is Our Business*

ALLISON DIVISION GENERAL MOTORS CORPORATION departmental review



# electrical engineering

written and edited
by the staff
of the electrical
engineering department

"DEPARTMENTAL REVIEW" is a series of articles written by members of the faculty at Rose. Each month a different department will describe for you the nature of their curriculum, some history of their profession, and what a student in their department might expect after graduation.

Because satisfaction during years of undergraduate study is so highly dependent on the proper choice of a curriculum, this series is designed to differentiate between the various fields of study at Rose and help the present and prospective student make his choice. Therefore it would be wise to consider the facts presented by these authors before making your selection of an undergraduate field of study.

"The professional electrical engineer is particularly concerned with communication systems for the processing and retrieval of information or data and with power systems for the production, conversion, transmission and control of electrical energy." Quoted from the current issue of the Rose Polytechnic Institute catalogue, this statement presents in general terms the technical responsibilities of the electrical engineer of today and of the future. A relatively young profession, this area of applied science has experienced rather dramatic growth in importance in our technological society. The breadth and complexity of the problems faced by those who have chosen to make it their life's work have increased markedly and rapidly. Without doubt the future holds promise of a continuing challenge to meet the needs of an expanding and demanding world population.

Historically, electrical engineering came into being in the 1800's following a number of significant discoveries by men, mainly physicists, working in the area of the science of electricity. Static electric charge, the effects of which were observed by the early Greeks, was the object of much investigation during the 17th and 18th centuries by such men as Hauksbee, Gray, DeFay, Van-Musschenbrock, Franklin and Galvani which laid the ground work for Volta's discovery of his "electric pile", now called a primary electric battery. This discovery, announced in 1800, making possible a continuous flow of electricity, was of primary importance for electrical science and subsequently for electrical engineering.

Within a few years Oersted had discovered electromagnetism; Faraday and Henry propounded the principle of electrical induction; Ohm developed the law of conduction which today bears his name; Maxwell derived his "Dynamical Theory of the Electromagnetic Field"; Hertz produced electromagnetic or "radio" waves; the work of Plucker, Hittorf, Crookes, and Thomson with cathode rays, gave the first physical evidence of the electron; Becquerel discovered radioactivity; Preece and Fleming explained the Edison effect.

These few discoveries, along with the necessary mathematics and knowledge of materials, constitute the basis for modern day electrical engineering. The direct application of the principles underlying them led Morse to the invention of the electric telegraph in 1836, which with subsequent improvements, paved the way for the first efficient long distance point-to-point system of communication. In 1858 the first transatlantic telegraph cable was completed. During the same period, the telephone was being developed culminating with a patented system by Bell in 1876. By 1900 Marconi had developed the wireless for effective long distance communication. As an outgrowth of the work of DeForest, Fessendem, and Armstrong in the early 1900's, the special field of electronics became one of the basic disciplines of electrical engineering. Coupled with the growing knowledge of electric circuit theory, both analysis and synthesis, these modest beginnings ultimately have produced our vast radio, telephone and television networks, the modern aircraft and naval navigation systems, and numerous other applications of unparalleled complexity.

Simultaneous with these advances in the communications area, developments in electric power generation and utilization were rapidly expanding the practical usefulness of electricity. As early as 1835 an electric generator had been built in England and subsequently an electric motor, based on Faraday's discoveries, was built in 1837. Spurred by Edison's discovery of the incandescent electric lamp, the use of electric power in direct current form increased rapidly. Serious transmission limitations in the direct current power systems led to the development of our present day alternating current system which makes possible the efficient and economical use of almost unbelievably large amounts of electric energy. Although begun in the early 1880's in Europe, Westinghouse and Stanley in America developed the necessary refinements to provide for an efficient alternating current system. Tesla, in the late 1880's was awarded a patent for the first polyphase system from which today's massive electric power industry has grown. Uncounted types and sizes of motors, generators, electric lamps, electric heaters, and appliances have evolved in less than a century. There seems to be no end to the stream of new applications of economical and convenient electrical energy.

The advent of atomic energy has given impetus to new developments in the power generation field which promise to revolutionize power plant design with applications in the important areas of transportation. The developing area of fuel cells, solar cells and ionize gas generators gives promise of outstanding advances in power generation.

Of necessity, the above developments were paralleled by the invention of a versatile line of measuring instruments designed to provide accurate quantitative measures of electrical current, voltage, power and energy as well as circuit parameters. The continued improvement of electrical instruments, coupled with early work in feedback amplifiers, gave rise to the disciplines of servomechanism theory and automatic control systems. Under the pressures of the requirements of radar detection and fire control systems during World War II, control system analysis and design has emerged as a distinct facet of electrical engineering.

Applications of electrical instrumentation and control have been extended to all fields of engineering making possible the automatic control of an extremely wide variety of manufacturing and material processing systems including the modern day manufacturing system known as automation.

In the late 1940's the development of the electronic digital computer led to another outstanding and important area of interest for the electrical engineer. Basically a system of automated logic, this amazing machine makes possible the solution of analysis and design problems heretofore considered too long or too complex to be completed by manual computational methods. Far from the electronic brain that it is popularly conceived to be, it nevertheless can be instructed to make simple decision and, in a sense, exhibits the basic ability to "learn" from the results of these decisions. Used as a part of an automatic control system, it makes possible sys-

(*Continued on page* 26)

# science god

written by
jerry badger
sr. math.

Today we find many references to science and scientific achievements. We often see statements like "Science has proven that . . . ", or we accept what a scientist says without question. But what do we do when one scientist says something and another scientist says that he is wrong. Can our science permit a question to be answered by both "yes" and "no" at the same time? For instance one scientist may say that nuclear bomb testing will doom us, and another scientist may say that the increase in radioactivity is negligible and will have no effect on humans. Now which scientist is right?

In the preceding paragraph we have assumed a distinct "yes" or "no" answer, but there may be no such answer; perhaps both scientists are partially correct. It might help us to know what each scientist based his decision on and what assumptions he had to make.

Our science seems to answer many questions, but just what is this man-made creation we call by the name "science"? To limit the topic I will think only of physics, but similiar arguments are applicable to the other branches of science.

The engineer or scientist has his head crammed full of laws, formulae, et cetera which are supposedly necessary for the work he is to do. It can be beneficial for an engineer or scientist to try to get outside science and look back in to get an overall view of the structure of this product of the human mind. Science talks about the physical world. The "understanding" one has of science can be expanded by stepping up one level and talking about a science of science. What enables us to take a given set of conditions and predict the outcome of an experiment? What process do we actually go through to solve a problem?

Suppose that some early cave man had accidentally constructed what we call today by the names battery, light bulb, switch, and wire; and suppose that he had hooked the battery, bulb, and switch in what we call a series hook up. Using our present terminology to describe the situation, we will agree that the bulb glows when the switch is closed and does not glow when the switch is open. Being engineers and scientists we have been taught the answer to why the bulb glows when the switch is closed and does not glow when the switch is open.

The cave man's reasons for why the bulb glows might be as follows. The bulb contains a light bulb god, and this god is pleased when the switch is closed and displeased when the switch is open. When and only when he is pleased, he lets his light shine forth upon the world. When either the battery ran down or the bulb filament burned out, the cave man would probably decide that the light bulb god had died. The cave man's explanation of this phenomenon would be just as pleasing to him as our explanation today is to us.

If this cave man taught school, and if one of his students parroted back this explanation as the answer to a test question, then the student would be told that his answer was "right"; and he would receive a pat on the back. In school today this has not changed too much; the answer which is pleasing to us has of course changed, but the student still gets a pat on the back for the "right" answer.

So the student with the "right" answers (those most pleasing to the teachers at the present time) gets a grade of A in the course, and after enough A's in courses he perhaps feels that he really knows something about the physical world. But this only shows his ignorance of the science he has been studying.

The science we study is a science made up of *models*. Consider a block on a board which is inclined at an angle to the horizontal. We pick out from the total event around us two "separate and distinct"[1] objects, and we also separate these from the rest of the event. We then draw a picture to represent these things which our language conveniently isolates for us, but this picture is not the "block" and the "board";[2] this picture is only a model. We then try to write down something in the language of mathematics to characterize the behavior of the model. For this example we could use Newton's law, F = ma. We hope that our characterization of the behavior of the model will correspond to the observable behavior of the physical system.

We also hope that our model includes all the major controlling influences in the physical system. To include all the controlling influences is certainly impractical if not impossible. For instance we seldom include the observer as a part of the system, but he is; sometimes he may be a major controlling factor. A man steps up to his television set to tune in a particular channel. When he steps back, the picture fades out. As he steps up to do more tuning the picture returns. So the observer seems to be a part of the system.

The preceding paragraph has the word "control" in it several times (in some form). Usually we are careless in the use of this word. This word is not inherent in the physical world; it is part of our vocabulary, and it illustrates an important part of the thinking processes of a scientist. We often think in terms of control, and we act as if the thing which we assume is doing the controlling is actually doing the controlling in the physical world. The word "control" sneaks in the ideas of something being controlled, some process of controlling, and something doing the controlling. These are human ideas, and it does not follow that these ideas have counterparts in the physical world.

To return to the solution of the block and board problem, we write down a statement about the model and then apply the only tool available, namely mathematics, to determine the behavior of the model, which we hope will enable us to predict the behavior of the physical system. The reason that mathematics is the only tool available (at least at present) is that mathematics is a creation of man's mind which does not rely on observations in the physical world.[3] In physics a new theory usually replaces the theory before it, i.e.. new phenomena give rise to new descriptions and explanations. But a new system in mathematics does not replace the old system.

When we have completed the theoretical solution (the solution of the behavior of the model), we go to the actual physical system and make some measurements, which are human ideas and not an inherent part of the physical world. Distance, time, force, mass, et cetera are only human ideas.

If we verify our predictions by experiment, then we can conclude "it worked this time," and no more. We may try the same approach on other systems; and if it works for them, then we feel more confident using this method to predict the behavior of new physical systems, i.e., systems with which we have not yet experimented.

If we find that our predictions are not verified by experiment, then we can conclude "It did not work this time," and no more. As for why this method did not work, why should we expect it to work? There is nothing in our model or our analysis to tell us that we have all the controlling factors, and we have no reason to expect our analysis to work except that it has worked before. Perhaps a new mathematical system would give a result that was experimentally verifiable, or perhaps we should revise our ideas about the physical world and write down something else in place of Newton's law.

We could explain all physical phenomena by the statement "God so willed it," and this was done to some extent in the past. However, such a statement is worthless for making any predictions about some new, as yet untried, physical system. In our science today we demand that a theory give behavior in the model which is experimentally verifiable in the physical world. Further, the theory must have predictive value, i.e., it must enable us to predict the behavior of new physical systems. We hope that the theory will also point the way to the design of new physical systems, some of which may be useful to man. The cave man's explanation of the light bulb pleased him, but it does not please us because we can not predict the behavior of new systems with his description.

Science is not the study of the physical world but is only the study of *a* useful way of *viewing* the physical world. The preceding sentence used the word "a". The use of this word instead of "the" is most important. Our science is only *a* useful way of viewing the physical world and not *the* useful way of viewing the physical world. The viewpoint we have today may be replaced tomorrow by a new viewpoint which better serves us and leads to theoretical predictions which agree more closely with experimental results.

We may even change our viewpoint from one problem to the next. For example, we thought of the block in the previous discussion as one entity in itself. But we could have thought of this block in terms of its atomic and molecular structure. However, this would have unnecessarily complicated the problem. In the next problem we try,

(*Continued on page* 25)

1 These are separate and distinct according to our language and labeling system.
2 The quote marks are used to distinguish the thing from our name for the thing.

3 Although Mathematics was originally motivated by observations of the physical world, it has outgrown this.

# rally round the senior bench

*Editors note:* The following piece of literature was a group effort by the TBPi pledge class. Those making contributions were:

philip chute
gregory bolt
bill crynes
joe snyder
jerry badger

Realizing the importance of the senior bench, we the members of the Tau Beta Pi pledge class "volunteered" to investigate the development of an indestructible senior bench. After weeks of arduous research, we hereby present the following monumental plan for the senior class to execute.

We deem it necessary for the sake of clarity to itemize the essential elements to be utilized in the construction.

1. Rose's antimatter machine (patent pending!)
2. One 14th century atlas
3. One bilinear transformation (a transformation of the form $W = \frac{(AZ+B)}{(CZ+D)}$
4. One extremely capable senior class
5. One complex variables mathematician
6. The Rose shop
7. Newtonian Reference System
8. The area immediately surrounding the large oak tree in front of the main building

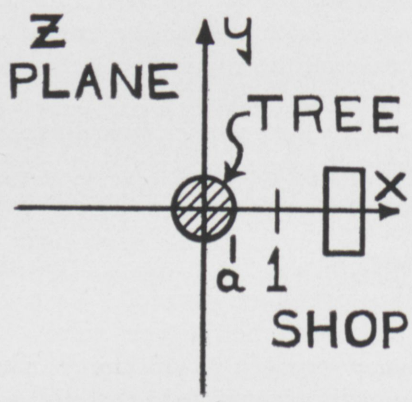



FIG. 1

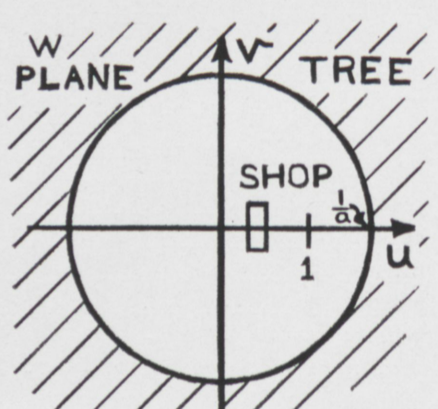



FIG. 2

9. One ideal voltage source stolen from the EE department
10. A complex plane
11. Papier-maché

Since we desire to perform a transformation using the large oak tree in front of the main building as our origin, we thought it advisable to check and make sure the contour of the earth was such that the transformation could be performed. Upon referring to a good world atlas, it was found that the world is as "flat as a pancake,"[1] thereby insuring us that the transformation can be performed with a minimum of effort. We then proceed to pick two sets of axes (x & y, u & v) through the center of the oak tree. Let the unit (1) be half the distance from the origin to the Rose shop. Consider the complex variables $z=x+jy$ and $w=u+jv$. Gather the materials and construction workers into the Rose shop. See Fig. 1.

Perform the transformation $Z=\frac{1}{w}$.

The result is shown in Fig. 2. The tree is now outside, and the rest of the world is inside.

Build the bench as close as possible to the tree as shown in Fig. 3. The bench must be large enough so that it can not be moved away from $w=0$, i.e., the diameter must be greater than $\frac{(1)}{(a)}$. Note that the bench being built in the w plane must be inverted so that it will turn out to be a real bench in the z plane.

In an effort to keep the cost of materials & the rising labor costs to a minimum, it was decided to use papier-maché as a preliminary material. Then, upon focusing the Rose antimatter machine upon the papier maché, presto, Rose's antimatter appears. This would seem to be an excellent opportunity to define what is meant by Rose's antimatter. This is simply a unique type of "stuff," which, upon coming into contact with matter causes the matter to disappear.

Now that the bench is finished,

1 Polo, Marco, *World Atlas*, 1309, Venetia

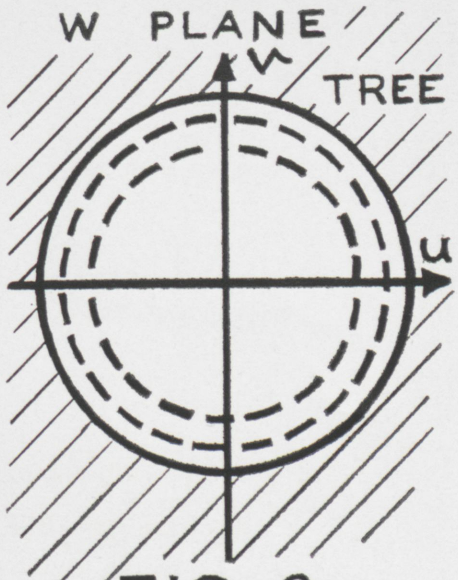



FIG. 3

perform the inverse transformation $w=\frac{1}{Z}$ and the bench is now around the tree. See Fig. 4.

*Caution:* While performing this transformation, do not stand too close to the origin; you would have a long walk back to campus.

Now, in an effort to protect all good beings from our creation in this best of all possible worlds, we will set up a fairly strong field in the following manner.

Put an ideal voltage source in the oak tree. Wind a few turns of resistanceless wire around the tree and connect the wire to the voltage source.[2] The infinite current will set up an infinite repelling magnetic field around the tree. The field will repel all matter because of the electrons revolving in the matter but of course will not disturb the antimatter. All engineers know that the effect of a field decreases as the distance from the source of the field increases, so a few feet from the tree, the effect of the field will be negligible.

As any matter approaches the bench, the field will repel the matter, but an equal and opposite force will be exerted on the tree. To keep the tree from moving, we suggest roping it securely to the origin of a Newtonian Reference System. Now, if due to some tendency toward quiescency, the senior class does not care to execute this "practical" scheme; we suggest the following rationalization. The senior bench is actually an idea which exists in the minds of seniors. As long as there is a senior, there is a senior bench. For there not to be a senior bench, there must be no seniors; but if there are no seniors, who cares if there is not a senior bench?

2 The acquisition of this wire is left as a Technological detail for the senior Electrical Engineers to solve.

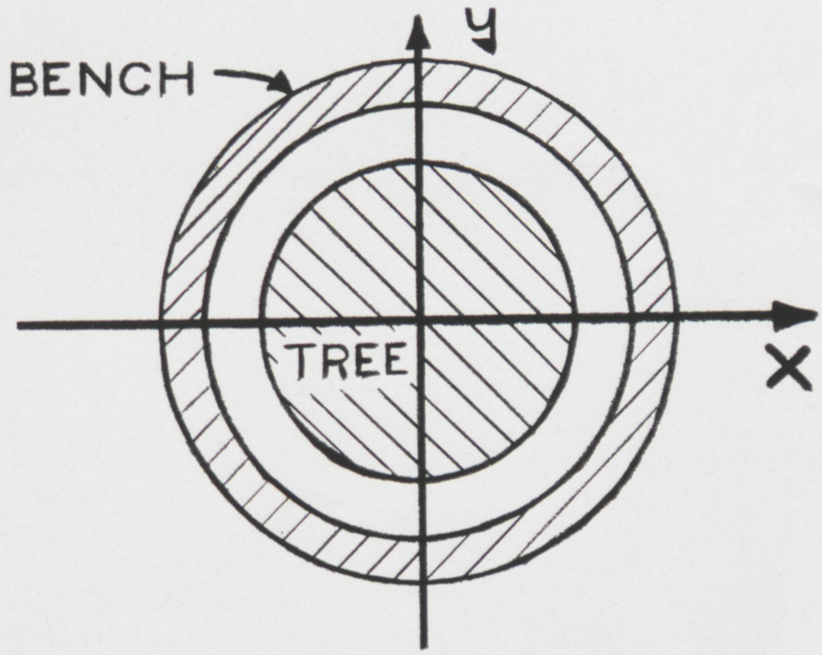
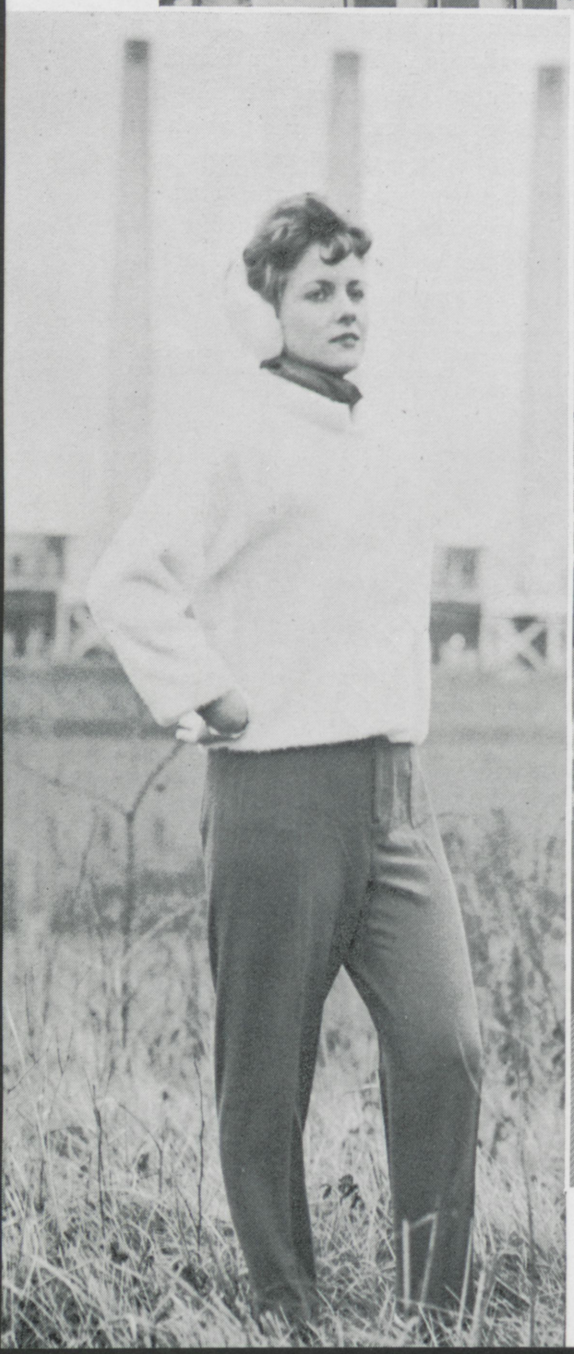



FIG. 4

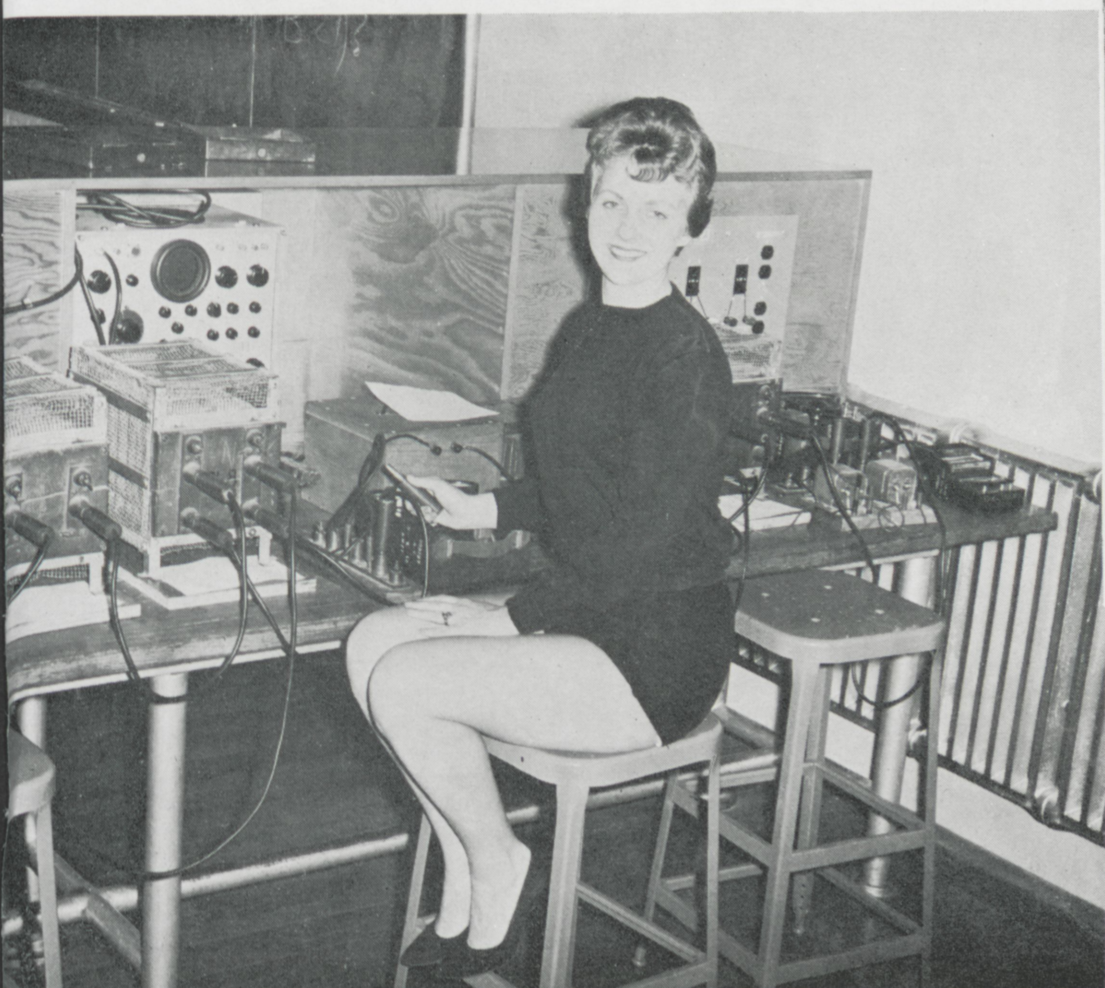

DANGER


# miss technic for january

The staff of the Rose Technic would like to cast another vote in favor of coed engineers. Miss Helen Edington, the pretty lass who graces these pages, is trying to prove again this month that women are competent engineers.

Helen is a freshman AOPi pledge at Indiana State College. Unfortunately for the interests of the profession, she is not an engineering student. Rather, her educational interests lie in the Foreign language department.

Miss Edington is a nineteen year old beauty with blue eyes and sandy blond hair. She stands 5′ 2″, weighs 115 pounds and measures 35-25-35. She sure gives us a charge!



# solid state physics

## in industrial control systems

by dave morgan
soph. physics

In the coming years as automation becomes more and more widespread, the uses for the amazing phenomena of solid state physics will snowball. A great potential field is rapidly developing and new uses are found constantly for these effects. Largely the field is a new one, but there are phases of it in control engineering which have been with industry for many years.

Solid state effects cover a wide area since the term covers every characteristic phenomenon of solids; however, the phenomena of most interest to industry today are those on the molecular and atomic levels. The general qualifications for a solid state device to be useful to industry for control systems are repetitive structure, periodicity, and predictability.

Some advantages of solid state devices are: (1) performance of controls impossible or extremely difficult and expensive with classical methods. (2) reduction of size of control systems, (3) reduction of weight, (4) reduction of power consumption, and (5) increased reliability and precision.

In use today is the well-known effect of radioactivity. This phenomenon is used in industry to determine the position of a certain substance during an operation, to determine the location of a trouble spot in a closed system which would be difficult and time consuming to locate in another manner, in other operations involving tracing of the position of a vital part of an operation, to determine the density and/or thickness by noting variation of radiation level due to differences in the nature and amount of material between the radiation source and the detector.

Probably the most important and most widespread use of solid state phenomena are the strange phenomena of semiconductors. Semiconductors are utilized in almost every automated industry because of their myriad utilitarian properties. The potential of these devices is terrific as there are many phenomena of these materials about which little is known, but which when developed will revolutionize the controls industry.

Semiconductance is the ability of materials between good insulators and good conductors to conduct electricity having resistivities in the range of $10^{-4}$ to $10^{4}$ ohm-meters. A characteristic of some semiconductors known as intrinsic semiconductors is that their conductivity depends on the temperature, which is of interest in applications where temperatures are to be measured accurately and controlled to stay within a certain range. Germanium is one of these intrinsic semiconductors and has the highly desirable property of approximately linear variation in conductivity with temperature (logarithmically). "Doping" of semiconductors, i.e., adding precise amounts of impurities, changes the conducting properties of the material to produce a desired effect. The doping changes the material to either a "P"-type in which current is carried by "holes", i.e., places where an electron is missing from the band just below the conduction band in an atom, or to an "N"-type of material in which current is carried by means of electrons. Junctions of P and N materials have effects which are utilized in the circuitry of the digital computers and memory units that control automated processes. Power transistors and silicon controlled rectifiers, which are semiconductors, are used as control system power modulators replacing banks of relays. Such things as pulse modulation and phase commutation can be controlled by semiconductor devices in power plant control.

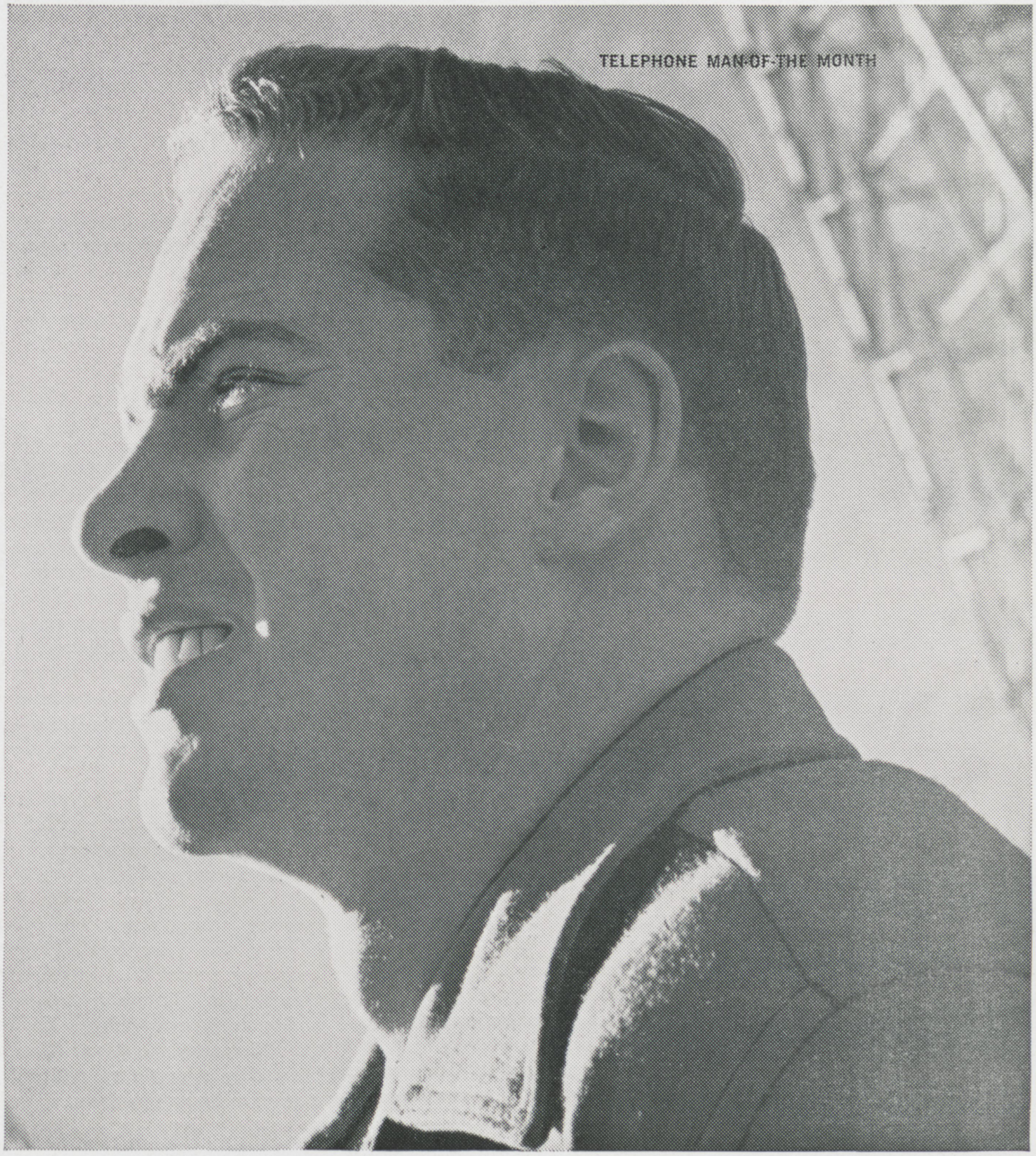
The Hall Effect is solid state phenomenon in which an electric field is produced when a bar of semiconductor or conductor material is placed in a magnetic field perpendicular to the axis of the bar, and a current is flowing axially through the material. This effect is used to determine the conducting properties of semiconductor materials and is used in the control systems in the production of such materials.

Photoelectric cells and materials (called solid state light sensors) are used to indicate position. Photovoltaic cells generate a voltage proportional to the light intensity and is the only type of cell able to power electronic equipment directly. Photoconductive cells have resistivity inversely proportional to light intensity. Wherever in industry one desires to determine the presence or absence of light one uses this type

(*Continued on page* 28)

# THE BELL TELEPHONE COMPANIES SALUTE: BILL PIGOTT





# r & d

written by
dave rice
soph. mech.

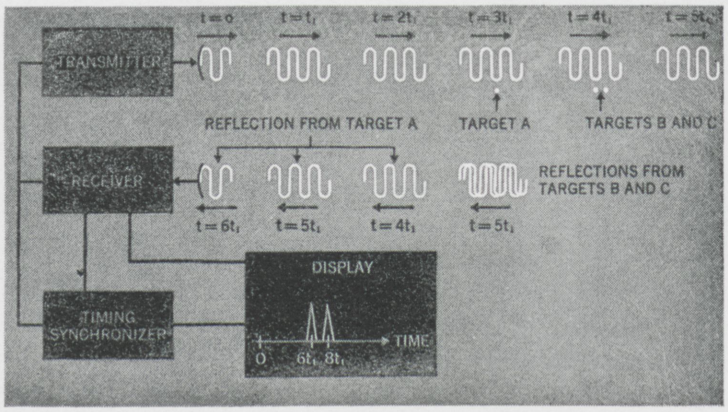



Figure 1

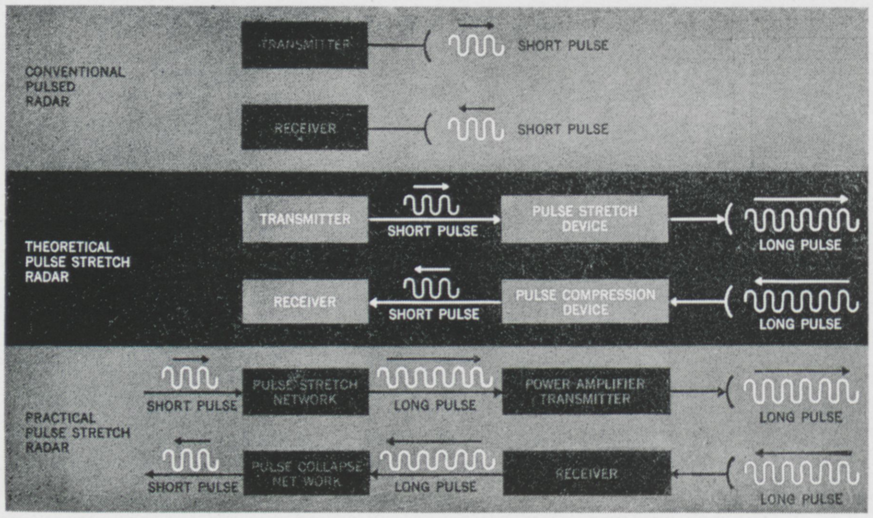



Figure 2

Any modern defense system can only be as effective as its method for obtaining advance notice of attack; and since 1938, when the first long-range surveillance radar went into operation on the east coast of England, radar has been a basic element in the warning system. Improvements have been forced by the increasing speed of aircraft at a much longer range. This situation was further complicated by the fact that the newer planes and missiles present a much smaller radar target.

The range of radar is proportional to the fourth root of the average radiated power. However, because of the very nature of pulse radar, the type most commonly employed today, an increase in average power is particularly difficult to come by, even though modern radar transmitters can generate peak signals in the megawatt range. Inspection of Fig. 1 reveals two criteria for any radar system: (1) if the radar is to be able to resolve targets effectively, each pulse must be short; and (2) sufficient time must be allowed between pulses to enable the pulse to travel to the target, and be reflected to the receiver. This obviously means that in any sensitive, long-range pulsed radar system, the transmitter will be radiating only a small fraction of the time—typically, from one to five percent.

The obvious approach to improving range is to develop microwave oscillators or power amplifiers that will deliver any desired peak power level. However, even if this were possible, the difficulties of transferring power from the point of generation to the radiating antenna become insurmountable.

Obviously, the easiest way of increasing average power would be to increase the pulse length, keeping peak power fixed. But with conventional radar, this would degrade its ability to resove targets. Fortunately, the answer to this problem has been at least partially answered by a relatively new development, called *pulse stretching.*

Key to the pulse-stretch system is an "all-pass" filter that has a nonlinear phase characteristic, so that all frequencies will pass through the filter but with a different group delay for each frequency. When a pulse, which theoretically consists of many frequencies, is fed into the filter the various frequencies in the pulse are shifted relative to one another in time with an overall effect of stretching the pulse (Fig. 2). Enormous amounts of phase distortion (normally to be avoided in communications equipment) have been deliberately introduced.

When the stretched pulse reflection enters the receiver, it is passed through the same type of all-pass filter, which recompresses the pulse to its original length. Hence, the long pulse radar can give the equivalent resolution of a short pulse.

Unfortunately, pulse-stretch techniques cannot fulfill the total needs for increased power. Even if the pulse is stretched to the point where the transmitter radiates 100 percent of the time, the need for more radiated power will remain.

The next logical step in the search for more power will be the phased array. This, in principle, amounts to driving a number of transmitters in parallel and adding their outputs in space. The phased array not only permits the addition of power contributions in space, but also has directive characteristics not unlike those obtained with the dish-type reflectors of present-day radars.

A final advantage of the phased array is the posibility it yields of controlling the direction of radiation electronically. Indeed, by varying the relative signal phase of the individual radiators the direction of radiation of power can be controlled. By using pulse stretch and phased array techniques simultaneously, the range of future radars will have no theoretical limitations, except perhaps as to whether space itself can withstand the potential gradients and stresses induced by such large amounts of radiated power.

The earliest pulse radars gave reasonable range information and, because of low frequencies and wide beam widths, somewhat less accurate angular information. Since height can only be determined directly by measuring small elevation angles, the resultant accuracy was poor. Moreover, in an operational system, the most important information required is plane (horizontal) position, so that ground-based search radars naturally evolved towards two-dimensional systems.

With the development of higher frequency, and hence narrower beamwidths, and more accurate radars, target altitude could be determined with separate radar. This radar, given the name "nodding beam height finder," is made to search in elevation on a certain azimuth indicated by the main search radar.

The primary limitation of the nodding-beam system is the low rate at which altitude information can be obtained. This slowness of operation is somewhat compensated for by the fact that the height of a target normally varies more slowly than its other coordinates. On the other hand, it might change radically at a critical moment so that the nodding beam height finding system can fail precisely when it is most needed.

As aircraft performance improves with higher speeds, higher ceilings, and higher rates of climb, the interception problem becomes more and more difficult and the time available allows no errors. The position of all targets must be determined in three dimensions at the maximum rate possible by an integrated 3D radar.

The accuracy required is usually about ±1000 feet at 100 miles, with search coverage out to 200 miles and up to at least 60,000 feet. This corresponds to an angular accuracy of ± .1 degree. With sufficient care, angular measurement with a radar can be made to roughly a tenth of a beamwidth. Hence, the ± .1 degree accuracy requirement calls for a one-degree beamwidth in both the vertical and the horizontal dimension.

The next basic problem is one of data rate. Despite the fact that the velocity of electromagnetic waves in air is greater than the velocity of any other useful phenomenon by many orders of magnitude, and can be considered as infinite in most practical applications, its meaurement is fundamental to radar and its absolute value imposes a definite limitation in the design of a three-dimensional search radar.

Though the hemisphere can be scanned in a number of ways, the usual method is for the beam to scan rapidly in elevation while the pedestal rotates at a slower rate. The high rate of vertical scanning requires the scanning to be carried out electronically.

In the early days of radar, long range three-dimensional information of a sort could be obtained with reasonable accuracy, at least at sea, by observing the fade pattern of the track of the target aircraft.

By noting the ranges at which fades occur, it is possible to estimate the height of the target but this process is slow and only suitable for aircraft flying at a more or less constant altitude.

An early attempt at obtaining height information simultaneously with plan information led to the design of the "V beam" system. This system consists of two separate fan beam radars, one vertical and the other inclined at 45 degrees. Each target was therefore seen twice. The time interval between the appearance of a target on radar and its appearance on the other depends obviously on the elevation angle. Suitable displays were designed to give the height information directly. The disadvantages of this system were size, difficulty in obtaining high coverage, and difficulty in correlating the two echoes at high elevations. In particular, it was wasteful of transmitter power since the maximum search range is in no way improved by the second transmitter.

Present-day long range 3D radars overcome the data rate problem by generating a number of separate

(*Continued on page* 26)

# library notes

written by carson bennett and winifred kitaoka

SATURATION

Good-bye to shows
With smoking guns;
Good-bye to skits
With hackneyed puns.

I've had my fill
Of contest prizes,
No matter what
Their mammoth sizes.

Tonight I'll snub
All Western badmen;
Nor will I yield
To TV ad men.

For me no plays
Or ad-libbed wit;
Tonight I'll read
With screen unlit.

Albert W. Dowling

We recently received a collection of books and periodicals from Dr. Crawford F. Failey, a member of our Board of Managers, in the field of astronomy. This fine group of books and periodicals have added valuable resource material to our collection in this area.

We list some of the titles included in the gift:

*Galaxies,* by Harlow Shapley, is one of the books from the "Harvard Books on Astronomy" series. It treats the greater star organizations, the other galaxies, that lie beyond the bounds of the Milky Way. Also part of the series are the following:

*The Milky Way,* by Bart J. Bok and Priscilla Bok.

*The Story of Variable Stars,* by Leon Campbell and Luigi Jacchia.

*Telescopes and Accessories,* by George Z. Dimitroff and James G. Baker.

*Our Sun,* by Donald Menzel.

*Atoms, Stars and Nebulae,* by Leo Goldberg and Lawrence Aller.

*Earth, Moon and Planets,* by Fred Whipple.

*A Guide to the Planets,* by Patrick Moore, is a guide for those who are engaged upon actual telescope observation of the planets, and who wish to learn something about our neighbor worlds. Also by Patrick Moore, is *A Guide to the Moon,* a "popular" book on the nearest of all celestial bodies—the moon. Without going into minute details, and avoiding mathematics, Mr. Moore presents essential facts about the moon.

*Skyshooting, Hunting the Stars With Your Camera* is written by R. Newton Mayall and Margaret L. Mayall, to give information, pleasure and "inspiration" to amateur astronomers and even just plain stargazers who have wished they knew how to use their cameras to record what they see and enjoy.

*The Comets and Their Origin,* by R. A. Lyttleton, presents observational features of comets which do not appear to be widely known, with the hope of renewing interest in the subject of comets.

*The Adjustments and Testing of Telescope Objectives,* by H. Dennis Taylor treats the telescope for the purpose of gaining the best advantage from the use of the instrument.

*The Bonner Durchmusterung,* or in English, the Bon Survey, by Friedrich Argelander catalogs the star-positions and corresponding charts, which is one of the most noteworthy aids in astronomy.

Cora Burwell in *Publications of the Astronomical Society of the Pacific* says of Bon Survey: "After more than half a century of celestial photography it is perhaps surprising that our most useful astronomical chart is one made a hundred years ago by hand from visual observations."

Among the periodicals received are: *Sky and Telescope; Publications of the Astronomical Society of the Pacific; The Observatory, a Review of Astronomy; and Journal of the British Astronomical Association.*

Recent purchases in the area of astronomy include the following titles:

*The Moon* by Zdenek Kopal describes in simple language our present store of knowledge concerning physical properties and conditions prevailing on the surface of the moon.

*The Stars* by W. Kruse and W. Diekvoss, two leading authorities, tell how our astronomers with star light as their only source of information have gathered a vast store of knowledge about the celestial bodies.

*Nine Planets* by Alan E. Nourse presents astronomy for the "Space Age."

*Space Astrophysics* by William

(*Continued on page* 31)

# greek briefs

## ALPHA TAU OMEGA

The month of December found the ATO's actively engaged in many social activities which brightened those long long weeks before Christmas vacation.

The first of these activities was a date party held at the house to decorate our Christmas tree. No reason doing work yourself when you can bring in good-looking help As if a tree decorating party wasn't enough, the Taus really got into the swing of Christmas activities with a trade party with the Delta Gammas from Indiana State to wrap Christmas presents. This party was in preparation for the Christmas party which is given annually for the orphans at Glenn Home. This party turned out to be as much fun for the Taus as it was for the children. The ATO's found themselves continuing to spread Christmas cheer as they joined with Indiana State's ATO club to carol.

A very enjoyable trade party was held with the AOPi's from Indiana State after the traditional pledge banquet at the house. Following the trade party, the pledges found themselves involved in activities which topped off an evening during which a good time was had by all (even including the pledges!).

Saturday afternoon December 16, Dave Morgan, sophomore math, Charlie Yager, sophomore electrical, Dave Cripe, junior mechanical, and John Reed, senior mechanical, were initiated at the house and became the new neophytes.

Some of the Taus were partaking of their own social activities as evidenced by the accomplishments of Brothers Snyder, Burrall, and Ward. Brother Snyder became engaged to Judy Rader, a senior at Indiana State. A pair of strangely related romances found Brothers Burrall and Ward pinned to Corene Geralds and Karen Daly respectively. Both girls are sophomores at St. Mary's.

December also found three Taus being honored for other than social activities. Brother Snyder was initiated into Tau Beta Pi after writing the winning pledge essay, Brother Fellows received a sizeable scholarship from the ATO national, and Brother Reeves, Class of '58, officially took over the office of Province Chief of Province XVII (the state of Indiana) of Alpha Tau Omega.

At the time this is written, the Taus are eagerly preparing to leave for Christmas vacation looking very much as if a rest is needed. The time of publication should find everyone having returned from Christmas vacation looking even worse than they did when vacation started. Oh well, chin up, semester break is coming!

## LAMBDA CHI ALPHA

The Christmas season was ushered in at Lambda Chi Alpha on December 6th, as the brothers gathered for the annual Christmas meal. The fine food prepared by "Mom" Rost was enjoyed by all and the decorations provided a Christmas atmosphere.

Each year the brothers of Theta Kappa give a Christmas party for those less fortunate than themselves. This year was no exception as the brothers were host to twenty-five bright-eyed children. Friday evening, December 15, the brothers and women from Union School of Nursing wrapped the presents for these youngsters aged three to six. Sunday afternoon, with "Santa" Hobbs presiding, each child received his own present. The brothers would like to thank Brothers Ron Johnson and Ed Blahut who were chairman and assistant respectively for the party.

Brothers Ban, Dumford, Lew, and Stockton are on the Rose varsity

(*Continued on page* 28)

# is america great?

by joe snyder
sr. physics

*Editors note:* **This is the winning individual TBPi pledge essay. It will be sent to the national office for judging on a national basis.**

When we think of the great nations of today, we think of geographic area, population, standard of living, and power. However, if we look through history for great nations, we look primarily for what accomplishments these nations have made, what influence they have had on history, what art they have produced, and what ideas they have had. All of the great nations of the past have been strong and have had a high standard of living for their time, and many of them have possessed a large amount of land and have had a large population, but none of these characteristics was what made them great. These were the fruits of their greatness.

A great nation must have capable, dedicated leaders; for a large group of people can do nothing without direction. Even more important, a great nation must have goals, else where are the leaders to lead? A nation which has goals and leadership still is nothing without the support of the people. The people must believe in those goals and have confidence in their leaders. This, then, is potential greatness.

Two things are lacking before this potential can be realized. The first is enthusiasm, which the leaders will have and will be able to communicate to the people if they are good leaders. The second is freedom from the interference of other nations so that this enthusiasm has room to work. Often, elimination of this interference is one of the necessary goals of a great nation.

If working toward goals is necessary for greatness, what happens when a nation accomplishes all of its goals? It has two choices. Either the nation may adopt new goals and work for them, or the nation can assume that it has arrived and sit back and enjoy itself. In the former case the nation will grow greater; in the latter case it will become decadent and die.

Young America had the proper potential: goals, leaders, belief in both, and support from her people. She gained enough enthusiasm and freedom from interference to work toward her goals, and America became a great nation. She acquired strength, land, population, and a high standard of living along the way. She became influential in the world and helped shape the course of history. Then, all the goals which had the support of the people were attained. Some new goals were proposed which did not challenge the

*(Continued on page 27)*

## Science God

(*Continued from page* 11)

it might be advantageous to think in terms of the molecular structure of the block.

This science we have constructed serves as a basis for making decisions concerning the manipulation of things in the physical world to bring about a desired result. But how far can we trust this science? Will its predictions always be correct? We must remember that we always work with a model of nature, and the predictions we make are based on the assumptions we make about nature and put into the model. There is no way to be sure that we have structure in the model which bears any relation to nature; we hope that our predictions are mirrored in nature, but they need not be.

A few years ago some scientists believed that man would never be able to exceed the velocity of sound. Today we see "Einstein has proven that no message can be sent faster than the velocity of light."[4] But what does the word "prove" really mean here. This word means that predictions based on our present model of the physical world indicate that no message transmission can exceed the velocity of light. But the model which is adequate for today may not be adequate for tomorrow's newly discovered phenomena, and tomorrow's model may point the way toward sending messages faster than the velocity of light. We never *prove* things about the physical world; we only *prove* things about our model.

So the science we have built is not to be worshiped as an omnipotent god which will always give us the right answers. We can trust science no farther than we have experimented and not fully there. The first try at an experiment may not produce the same outcome as the second try.

Today many people worship science. The phrase "Science has shown that . . ." makes the listener feel that the speaker must know what he is talking about. Labeling a person as a "scientist" or "engineer" means that whatever he says must be right. Engineering and science students tend to blindly accept what their great leader says. They follow all the way through a derivation agreeing with their teacher and nodding their heads affirmatively; but when the teacher reaches the end of the derivation, he discovers a mistake back at the beginning. The students had accepted this mistake as being correct and now wonder how they could have been so easily deceived. We must remember that the phrase "Science has shown that . . ." and other similar phrases can have no meaning until the reasons behind such conclusions are stated.

Perhaps the average man will always be mystified by the all powerful god of science, but at least the engineer or scientist can be aware that science is only a tool, built by the human mind, for the purpose of human control of the physical world.

4 This statement is often misstated. There are things in our current description of nature which do travel faster than the velocity of light.

## Electrical Engineering

(*Continued from page* 9)

tems which can change their behavior or adapt themselves in accordance with the environmental demands placed upon them.

Of great usefulness in all scientific and engineering work, this machine also can be built to process all types of information. Important applications in business accounting, inventory control, market analysis and forecasting, weather analysis, missile and satellite data reduction, aircraft control and a myriad of other areas promises a tremendous impact on our everyday lives.

Changing rapidly in size, speed and complexity as new materials become available, the design of these devices presents an intriguing challenge to the future electrical engineer.

It is apparent that the electrical engineer is greatly indebted to the physicist for the beginnings of his special brand of applied science. Many of the most important advances in the profession have followed closely the development of new materials or the discovery of new phenomena. This close relationship between the electrical engineer and the physicist (and the mathematician) will continue to be an important ingredient for active advancement of the field.

The future electrical engineer must be well grounded in mathematics, the physics of materials, electric circuit theory, electromagnetic field theory, and a host of disciplines in the engineering sciences. Hence the electrical engineering curriculum will continue to be rather theoretical while at the same time strong in the application of these concepts to the development of useful devices and systems. He will more than likely be both analyst and designer and will find a pressing need for continued education in order to keep pace with the developments in a field which is certain to continue its rapid technical advance.

## Research & Development

(*Continued from page* 2)

pencil beams. These are usually stacked in elevation, all in the same vertical plane. Each beam has its own receiver channel and the video are combined to provide the plan picture corresponding to a conventional fan beam radar. The data rate is, therefore, the same as for a 2D radar and the elevation coverage depends solely on the number of pencil beams generated.

These stacked beam radars fall into two categories: the stacked scanning beam and the overlapping stacked beam. The stacked scanning beam is equivalent to a number of nodding-beam height finders, each searching over a relatively narrow sector in elevation at a suitable nod rate, while rotating at the conventional speed of 5 rpm. The sectors scanned are continuous so that the total scanned angle gives the vertical coverage of the set. The principal problem associated with this system is how to achieve the scan. A mechanical scanning mechanism is normally bulky and, with a conventional reflector, the resultant shadowing would seriously impair the characteristics of the antenna. In one radar system, a lens is used instead of a reflector to overcome this problem. The lens consists of a large number of aluminum wave guide sections welded together, the longer lengths towards the outside of the lens speeding up the phase to produce a plane wavefront.

The second approach is the overlapping stacked beam radar where a number of independent overlapping beams in the vertical plane are used. The beams are made broader and are of lower power as the elevation increases since, for a given height accuracy, the required elevation accuracy decreases with the slant range. Each beam has a separate receiver output, and elevation is measured by comparing amplitudes of signals in adjacent channels. This method does away with the cumbersome scanning mechanism of the previously described stacked scanning beam radar. The system, however, has difficulties of its own: the beams must be accurately shaped and have controlled overlap. The receivers must have accurately matched input/output characteristics. By using logarithmic receivers, the difference between outputs of adjacent receivers gives a direct measurement of target elevation: the relationship between the difference in dbs of the outputs from adjacent channels and the elevation is linear.

The next generation of radars will no doubt employ phased arrays for electronically scanning the hemisphere by means of a number of high-powered beams. Automatic data processing will be used for extracting the information and performing such operations as threat evaluation and weapon guidance, which are generally carried out manually at present. Such automatic data processing will be necessary to meet the threat of small-section, high-speed, and high-approach angle missles.

## THETA XI

Due to numerous remarks concerning by last two articles, it is with a high collar and stiff upper lip, that I submit this report. I am hoping that I will no longer be required to sleep, assuming the pre-natal position, with the thermostat on my blanket turned up to ten.

It appears that we are finally recovering from the severe social slump, as Steve-o (signed R. S. on our housebills) Kern leads the way by having eased up on the muscular grip on the pin formerly his, now in the possession of a Miss Libby Wilson. Our little "emolument" seems to be quite effective, having netted numerous dollars, in triplets. Besides Miss Wilson, Misses Mary Ann Kelly, Irene Sonoda, and La Verne Lum, have brought Brothers J. Hellman, M. A. Izumi, and yours truly, three dollars closer to the glorious status of professional paupers. The last three payments were made (belatedly) for coquettery during the summer. Boy, some guys are real tightwads!

It looks as though the members of Theta Xi are in for a cold December sixteenth. By the time this article is published, we will have stripped the pedestrians of Terre Haute of their loose change, to be given to combat muscular distrophy. Actually, this is actually an underhanded poll to see just how charitable the people of Terre Haute are.

Seeing as the finesseable five will be on the knotty pine soon, rigorous training in the coefficient of bounce, and the trajectory of a basketball have been transferred from the "log log duplex decitrig" to the hardwood. So far the sharpening of keen minds, tourneys of chess have been raging, which surprisingly require a remarkable amount of physical exertion. Beware of the day the doors of Theta Xi are thrown open, out of which step (in bare feet) the new men, ready to challenge anyone, at anything, including SIPA-SIPA.

## Is America Great?

*(Continued from page 24)*

entire nation. The advancement of science and technology was a big enough task, but it did not interest the majority of the people. World War I was entered reluctantly and lasted only long enough to convince the American people that they really had arrived. Corruption and decadence reigned, leading to a depression. World War II temporarily provided life for a dying nation, as America united to work together once again, showing that America was not yet lost. However, the war was won and America again came to a crossroad.

One challenge America has today is Communism, which threatens her very existence, but Americans are not uniting to face this challenge. In this respect, the nearest thing to a goal they have is one of staying ahead of the Russians. Even this weak-kneed approach is only half-heartedly supported by the people. Many fail to realize the threat is as great as it is, and very few are willing to actively pitch in and help.

Americans do have one goal which the majority of the people support avidly. That goal is one of acquiring the largest amount of money possible and climbing the social ladder as high as possible. This idea which divides the people prevails at a time when the nation so desperately needs a unifying goal.

Even without the threat of Communism, America as she is today is doomed. She rides on the momentum of her former greatness, feeding on this greatness and not replacing it. America is no longer great. She is no longer even a nation, but a group of selfish individuals. These individuals are so wrapped up in their own petty ambitions that they cannot see America's plight. They are asleep.

Here, then, is the goal which Americans need, a goal which challenges each one of them: Wake up, Americans! Wake up and become great!

## Greek Briefs

(*Continued from page* 23)

basketball squad for the '61-'62 season. Brother Dumford was elected captain of the varsity squad by the members of the squad. Congratulations, Dave! Brother Ban, the only senior on the squad, broke his foot a week prior to the first game, but is expected to return to the hardwood before the season's end. Also Brother Dennis Karwatka has assumed the post of cheerleader for the Fighting Engineers. This is a position which has lain dormant and the brothers wish Dennis the best of luck in bringing out the spirit of the Rose student body.

Interfraternity basketball season's well in swing. This year the brothers are headed by Coach Dave Dumford. The brothers are looking forward to a spirited showing by the team and a successful season is anticipated.

Another brother has taken his pin from his pin-mate but has supplied a wedding ring in its place. Brother Mike Hayes and the former Miss Jane McQueen were formally wed on Sunday, November 5, 1961, at the First Methodist Church in Brazil, Indiana. The newly-weds will join forces on Mike's studies for a while and we are sure that Jane will learn to "engineer" him very well. Our best wishes to Mr. and Mrs. Hayes!

In order that we might fare better socially (certainly not at the expense of scholastics) we began our New Year's social program by hosting the young ladies of Sigma Kappa of ISC on Friday, January 5. We hope that some of the brothers found "the one" but lest some were not so fortunate, our social program will proceed during the second semester.

It was announced that the annual State Day will be held in Indianapolis this spring, on March 10 to be exact. The brothers were overjoyed to learn that in the drawings for the basketball tourney, Theta Kappa drew the ISC chapter in the first round.

All the brothers got another look at the freshmen at the second in the series of "get acquainted" parties, and vice versa. The brothers all now await rush anxiously, this anxiety being surpassed only by the desire to "get at those finals."

### SIGMA NU

Finals are once again upon us and there is a more subdued atmosphere then there has been at 831 South Center. The brothers came roaring back from the Christmas vacation with repaired attitudes and renewed drive. If this semester has been great all along, it's going to end in a blaze of glory, by gosh!

The "Twistmas" party held with the Zeta's from ISC the weekend before the holidays began was a huge success. I don't remember what we did at mixers before the advent of the twist, but I know that they are more fun now than they ever were.

The winter season seems to cause fraternity pins to cling a little less tightly to our sweaters, and tend to distribute themselves among the fair sex a little more easily. Among those with wandering pins is Brother Tom Davidson, who surrendered his to Miss Sandy Manthy. Brother Larry Hall gave his pin to Miss Sue Hawley, and Miss Bonnie Townsend is pinned to Brother Joe Grumme. Brother Lee Brda, our honorable leader, has presented his Lovelier to Miss Judy Shoe. Brother Bob Lovell and Miss Mary Cook are also pinned.

The Sigma Nu basketball squad is shaping up, having won the "round robin" tournament by defeating Lambda Chi Alpha and Alpha Tau Omega on the hardwood.

We enjoyed a brief visit to the house by Brother Charlie Smith the last week before Christmas. Charlie, as well as most of last year's ROTC graduates, is wearing Uncle Sam's green uniform now. I wonder if this should mean anything to us undergraduates.

Many of us made New Years Resolutions January 1st, but since the academic new year starts with the new semester, we are saving up to really let go with resolutions in February.

## Solid State

(*Continued from page* 18)

of semiconductor material. Photosensitive switches when used with direct current sources and exposed to light will turn on and remain whether the light is extinguished or not. When alternating current is used, the switch will go off when the light does.

Thermoelectric phenomena such as the Seebeck, Peltier, and Thomson Effect are fields of little application now but of great potential use in the foreseeable future. When two dissimilar materials are joined keeping the junctions at different temperatures a voltage is generated. This phenomenon is known as the Seebeck effect. Thermocouples which measure temperature use this principle. These are particularly useful in measuring temperature in critical yet remote areas. This is one of the areas needing development. The Peltier Effect is the inverse of the Seebeck Effect in that if an external voltage is applied across two joined dissimilar metals, one junction cools while the other heats. In small remote units where temperature control is essential for proper operation, this type unit in conjunction with either a thermocouple or an intrinsic semiconductor is used. Temperatures may be controlled very precisely through the use of this combination.

The phenomena of Cryogenics, i.e. superconductivity, impact ionization, etc., at low temperatures, are being explored for possible industrial applications in control systems.

Strain gage elements, employing piezoelectric crystals which produce voltages when squeezed, bent, or twisted, are used to control rolling mill loads and to weigh storage tank contents. This field also is ripe for further development.

Certain problems are particularly perplexing in the application of solid state phenonmena to control and other industrial operations, but as each of these problems is analyzed and solved, another wide application will be opened.

Of such is the history of science.

## ATTENTION ALUMNI!

The Indianapolis Rose Tech Club will hold a meeting on the evening of January 29, 1962. The meeting will be held at the Fireside Inn, 522 East Raymond Street, Indianapolis. A smorgasbord type dinner will be served. For further details contact Harvey Greene, 3371 North Gladstone, Indianapolis 18, Indiana.



ADVERTISING INDEX

## LIBRARY NOTES
(*Continued from page 22*)

Liller treats astronomical and astrophysical problems investigated from above the atmosphere. Results rather than problematical plans for the future are emphasized.

*Source Book in Astronomy,* 1900-1950, edited by Harlow Shapley is a collection of sixty-nine selections written by widely known scientists such as Albert Einstein, Sir Arthur S. Eddington, Sir James Jeans, and many others.

FROM THE NEW BOOKSHELF

*From the Shadow of the Mountain*
by Van Wyck Brooks

This is part of Van Wyck Brook's autobiographical series, carrying the story of his life and times from 1931 to the present. Thoughtful, charming and urbane, the book is filled with keen reflections on our times and their literature and our American literary heritage, and with intimate glimpses of the many noted writers and famous people whom Van Wyck Brooks has known.

It is a book that will appeal to Mr. Brooks's many followers, all those who like good autobiography, and to readers who enjoy literary and artistic recollections and criticism of the finest order.

*Spirit Lake*
by MacKinlay Kantor

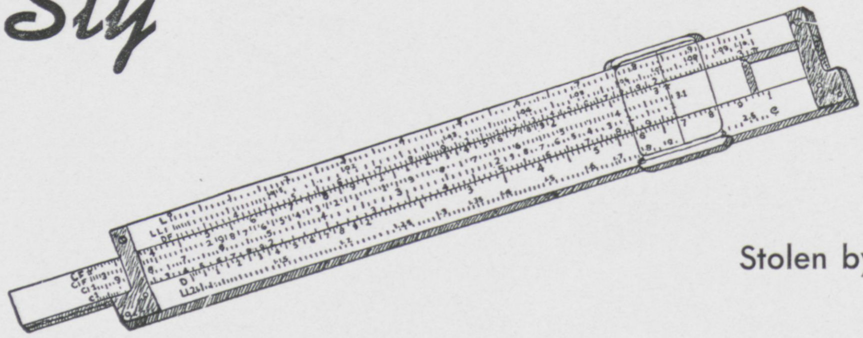
" . . . the truly great novel of the American frontier."

It is a hundred stories in one: the story of emigrant and immigrant, the outlaw's story, the little girl's story, the murderer's story — the story of the dedicated surgeon, hog-breeder, poetess, religious exhorter —of the Indian woman who harvests her crops in the midst of simmering violence. It tells of the men and women, and children who left New England to wide Iowa country—they came to make new homes. The American Indian rises in full fledged reality to make the reader conversant with the Indian manner and heart.

*Spirit Lake* is as much the saga of those who resisted as it is of those who came to take the land.



# Sly Droolings



Stolen by the editorial staff

On examining the old boy's baggage, the customs officer discovered a full bottle of whiskey. "I thought you declared you had only wearing apparel in this baggage?"

"Sure and that's quite true," replied the traveler. "That's my night cap."

* * *

**Two men were sitting in a bar. "Albert," asked one, "After you drink a lot, does your tongue burn?"**

**"I don't know, Sam," replied the other. "I've never been drunk enough to light it."**

* * *

We hear that Metrecal is being awarded the Nobelly Prize.

* * *

**A certain humanities professor was unpacking some glassware he had received from the factory. Seeing that one jar was upside down he exclaimed, "How absurd, this jar has no mouth." Turning it over he was once more astonished, "Why the bottom's gone too," he exclaimed.**

* * *

"Do you like dancing?"

"Yes, I love to!"

"Good, that's even better than dancing!"

* * *

**Found on fall registration card of freshman student:**

**NAME OF PARENTS—Mommy and Daddy.**

* * *

Lawyer, reading last will and testament to expectant relatives: "and so, being of sound mind, I spent every damn cent I had before I died."

**Prof: "Why don't you answer when I call your name?"**

**ME: "I nodded my head."**

**Prof: "You don't expect me to hear the rattle all the way up here do you?"**

* * *

Most essential qualification of an engineer: The ability to make your superiors believe your new idea will work—and to explain afterwards why it didn't.

* * *

**Proverb Dept.:**

**A bird in hand is worthless when you want to blow your nose.**

* * *

Kid Brother: "Give me a nickel or I'll tell Dad that you held hands with my sister."

E.E.: "Here you are."

K.B.: "Give me a quarter or I'll tell him you kissed her."

E.E.: "Here, pest."

K.B.: "Now give me five dollars."

* * *

**"You were away without official leave," his Superior barked. "Why?"**

**"Well, sir," the harassed private began, "My first day in the Army we were issued combs, and that afternoon all my hair was cut off. The next morning they issued us toothbrushes, and that afternoon the dentist pulled six of my teeth. The following day, I was issued an athletic supporter. That's when I went AWOL."**

M.E.: "How can you keep drinking that coffee?"

C.E.: "I take a spoonful of Drano every week."

* * *

**Then there was the meteorologist who could look into a girl's eyes and tell weather.**

* * *

Proverb Dept.:

A closed mouth gathers no feet.

* * *

**A certain brewer sent a sample of beer to a chemist to be analyzed. In several days the report came back.**

**Dear Sir:**

**"Your horse has diabetes . . . "**

* * *

Most of us spend the first six days of each week sowing wild oats; then we go to church on Sunday and pray for a crop failure.

* * *

**You can tell a lady by the way she dresses. If she were a lady she would draw the blinds.**

* * *

The little boy wanted $100 so badly he decided to pray for it. He prayed several weeks with no results. So he wrote God. The post office finally forwarded the letter to the White House. The President chuckled and ordered $5 sent to the boy. The lad, delighted that his prayers had been answered, in part at least, wrote a thank-you note to God but added this P.S.: "I notice you routed my letter through Washington and as usual the bureaucrats deducted 95 per cent."

# Kodak beyond the snapshot...

(random notes)

## One use for an artificial duck

On Sunday evening, September 24th, a new associate of ours named Walt Disney broadcast from 168 TV stations a film called "Mathmagicland." It featured an artificial duck he owns named Donald. The film illustrated the mathematical unity of nature and man, while the duck quacked in order to reassure 20,000,000 viewers that there is no harm in such a discussion.

Lots of kids who were too young for it will be ready next fall. Movies can teach conic sections as easily as pie-throwing. Movie-makers with lesser resources than Disney can also teach laudably. What bothers the classroom teacher about 16mm movies is how to get the one she wants when she wants it instead of seven weeks later. Nobody is to blame. The can of film has too many classes to visit, but relief is on the way.

Enter the *Kodak Sound 8 Projector.* It projects 8mm movies with commentary from a magnetic stripe on the film.

The greatly reduced cost and bulk of 8mm film and equipment got home movies off the ground. The improvement of sharpness and color in the 8mm Kodachrome II Film introduced last year is making movies really soar as entertainment in the home. In the schoolroom 8mm sound movies can be expected to simulate the effect of the paperback on the book business. The teacher will be able to handle a teaching film more like a weekly magazine and less like a shipment of gold bullion.

## A sharp eye for infrared

The decision to announce *f/1 Irtran-2 Aspheric Lenses* has been reached in struggle against inhibitions. In the photographic trade we are habituated to a longer silence before the first blast of the trumpets. Infrared technology hates to wait, however.

These lenses transmit usefully from $2\mu$ to $14\mu$. Three focal lengths, 1-inch, 2-inch and 3-inch, are offered off the shelf. At *f/1*, we seem to have done well at providing high collecting-power for energy without undue sacrifice of sharpness. Sharpness was the goal. For all the lenses, the minimum circle of confusion *computes* at less than .001″ for any wavelength from $4.25\mu$ to $10\mu$. Note italics.

In the $2\mu$-$3\mu$ region, the sharpness does not compute to be as good as farther out in the infrared. Yet we have customers who use the lenses there and are happy with confusion-circle minima as large as .008″.

In comparison with reflective optics hitherto used, Irtran-2 aspheres offer compactness and a wider field that doesn't even show appreciable deterioration as far as 2° off axis. You do give up the perfect achromatism of mirrors.

These remarks can be interpreted as a blatant offer here and now to sell these lenses for cash. (Address inquiries to Eastman Kodak Co., Special Products Division, Rochester 4, N.Y.) Irtran-2 material resists water and common organic solvents. It retains infrared transparency at high temperature.

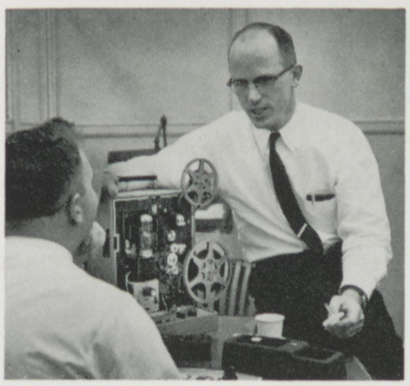
## The carboxamide way to solvation

The joy that philosophers once felt in considering an irresistible force acting against an immovable object is as nothing to the joy of the peddler who carries in his pack both an inorganic substance that resists common organic solvents *(see left)* and a solvent which dissolves inorganic substances which common solvents fail to dissolve.

$2.75 buys from Distillation Products Industries (a division of ours), Rochester 3, N. Y. 5 grams of *N,N-Dimethylbenzamide.* This comes as white crystals that melt at 42°C. It is a new member of a class of compounds of uncanny solvent power for high polymers, organometallics, and inorganics.

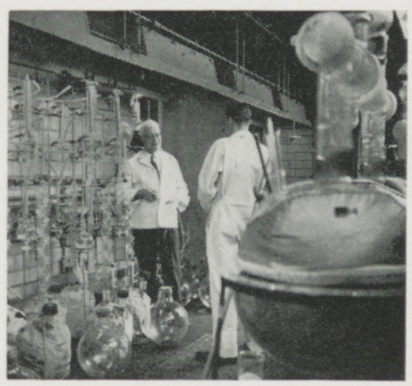
Solvation virtually demands the liquid state. Solubility also usually rises with temperature. Without the trouble and peril of high-pressure tactics, N,N-dimethylbenzamide can be maintained as a much hotter liquid than its cousins. It doesn't boil until 272°C, as compared with 152°C for N,N-dimethylformamide and 165°C for N,N-dimethylacetamide. Judged from some of the 17 other N-substituted carboxamides to be found among some 3900 Eastman Organic Chemicals we sell for research, it is probably a swell solvent. (Whether it dissolves Irtran-2 material, nobody yet cares.)

**Note:** Whether you work for us or not, photography in some form will probably have a part in your work as years go on. Now or later, feel free to ask for Kodak literature or help on anything photographic.



COST-CUTTING NEEDS GOOD PEOPLE

INFRARED OPTICS NEEDS GOOD PEOPLE



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One of a series . . .

*Interview with General Electric's Dr. J. H. Hollomon*

*Manager—General Engineering Laboratory*

# Society Has New Needs and Wants—Plan Your Career Accordingly

**DR. HOLLOMON** is responsible for General Electric's centralized, advanced engineering activities. He is also an adjunct professor of metallurgy at RPI, serves in advisory posts for four universities, and is a member of the Technical Assistance panel of President Kennedy's Scientific Advisory Committee. Long interested in emphasizing new areas of opportunity for engineers and scientists, the following highlights some of Dr. Hollomon's opinions.

**Q. Dr. Hollomon, what characterizes the new needs and wants of society?**

A. There are four significant changes in recent times that characterize these needs and wants.

1. The increases in the number of people who live in cities: the accompanying need is for adequate control of air pollution, elimination of transportation bottlenecks, slum clearance, and adequate water resources.

2. The shift in our economy from agriculture and manufacturing to "services": today less than half our working population produces the food and goods for the remainder. Education, health, and recreation are new needs. They require a new information technology to eliminate the drudgery of routine mental tasks as our electrical technology eliminated routine physical drudgery.

3. The continued need for national defense and for arms reduction: the majority of our technical resources is concerned with research and development for military purposes. But increasingly, we must look to new technical means for detection and control.

4. The arising expectations of the peoples of the newly developing nations: here the "haves" of our society must provide the industry and the tools for the "have-nots" of the new countries if they are to share the advantages of modern technology. It is now clearly recognized by all that Western technology is capable of furnishing the material goods of modern life to the billions of people of the world rather than only to the millions in the West.

We see in these new wants, prospects for General Electric's future growth and contribution.

**Q. Could you give us some examples?**

A. We are investigating techniques for the control and measurement of air and water pollution which will be applicable not only to cities, but to individual households. We have developed, for example, new methods of purifying salt water and specific techniques for determining impurities in polluted air. General Electric is increasing its international business by furnishing power generating and transportation equipment for Africa, South America, and Southern Asia.

We are looking for other products that would be helpful to these areas to develop their economy and to improve their way of life. We can develop new information systems, new ways of storing and retrieving information, or handling it in computers. We can design new devices that do some of the thinking functions of men, that will make education more effective and perhaps contribute substantially to reducing the cost of medical treatment. We can design new devices for more efficient "paper handling" in the service industries.

**Q. If I want to be a part of this new activity, how should I plan my career?**

A. First of all, recognize that the meeting of needs and wants of society with products and services is most important and satisfying work. Today this activity requires not only knowledge of science and technology but also of economics, sociology and the best of the past as learned from the liberal arts. To do the engineering involved requires, at least for young men, the most varied experience possible. This means working at a number of different jobs involving different science and technology and different products. This kind of experience for engineers is one of the best means of learning how to conceive and design—how to be able to meet the changing requirements of the times.

For scientists, look to those new fields in biology, biophysics, information, and power generation that afford the most challenge in understanding the world in which we live.

But above all else, the science explosion of the last several decades means that the tools you will use as an engineer or as a scientist and the knowledge involved will change during your lifetime. Thus, you must be in a position to continue your education, either on your own or in courses at universities or in special courses sponsored by the company for which you work.

**Q. Does General Electric offer these advantages to a young scientist or engineer?**

A. General Electric is a large diversified company in which young men have the opportunity of working on a variety of problems with experienced people at the forefront of science and technology. There are a number of laboratories where research and advanced development is and has been traditional. The Company offers incentives for graduate studies, as well as a number of educational programs with expert and experienced teachers. Talk to your placement officers and members of your faculty. I hope you will plan to meet our representative when he visits the campus.

A recent address by Dr. Hollomon entitled "Engineering's Great Challenge — the 1960's," will be of interest to most Juniors, Seniors, and Graduate Students. It's available by addressing your request to: Dr. J. H. Hollomon, Section 699-2, General Electric Company, Schenectady 5, N.Y.

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*All applicants will receive consideration for employment without regard to race, creed, color, or national origin.*